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Ebrahim

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[54] **LINKING RELATED DATA IN A DOCUMENT SET INCLUDING A PLURALITY OF BOOKS WRITTEN BY DIFFERENT GROUPS OF AUTHORS IN A COMPUTER NETWORK**

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[51] **Int. Cl.**[6] **G06F 17/30**

[52] **U.S. Cl.** **707/501**; 707/104; 707/513; 707/532; 707/537

[58] **Field of Search** 707/101, 102, 707/103, 104, 501, 511, 513, 514, 532, 537, 907, 10; 345/331, 329; 704/10; 395/200.48, 200.49

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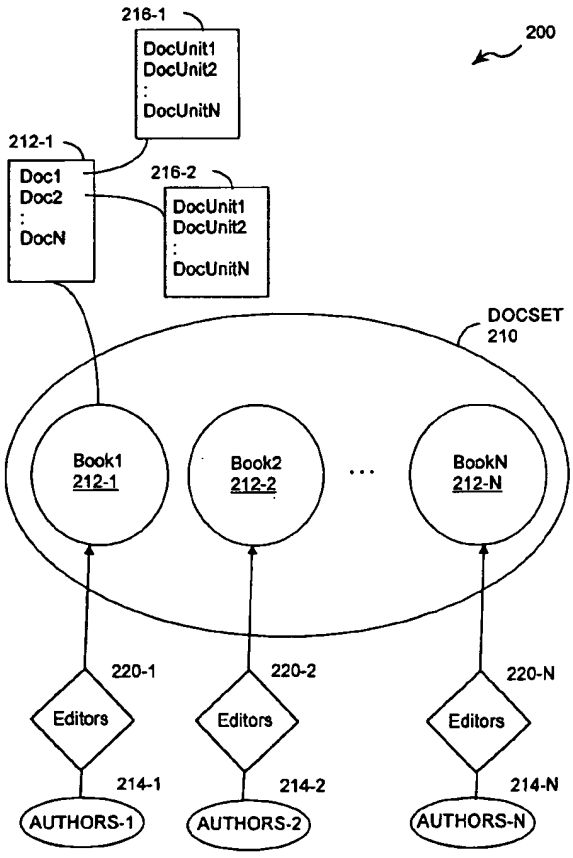
[57] **ABSTRACT**

Particularly, a system and method are disclosed that enable an author of a subsection of a document quickly to locate referenced information in other parts of the document or different documents prepared by other authors and then incorporate that information in their own document. An author tags information in their document that other authors might wish to import. Each time the document is updated, or as requested by the author, the author's tags and other tags that reference information that is importable by default (e.g., section headings, figures, tables) are exported to a tag repository that is accessible to all other authors. The tag repository also holds the tags generated by other authors from different documents. Using information finding/linking programs any of the authors can search the tag repository and select tags corresponding to information they would like to import into their own documents. The information can be imported by reference, by hypertext link, or by simple copying, among other techniques.

39 Claims, 7 Drawing Sheets



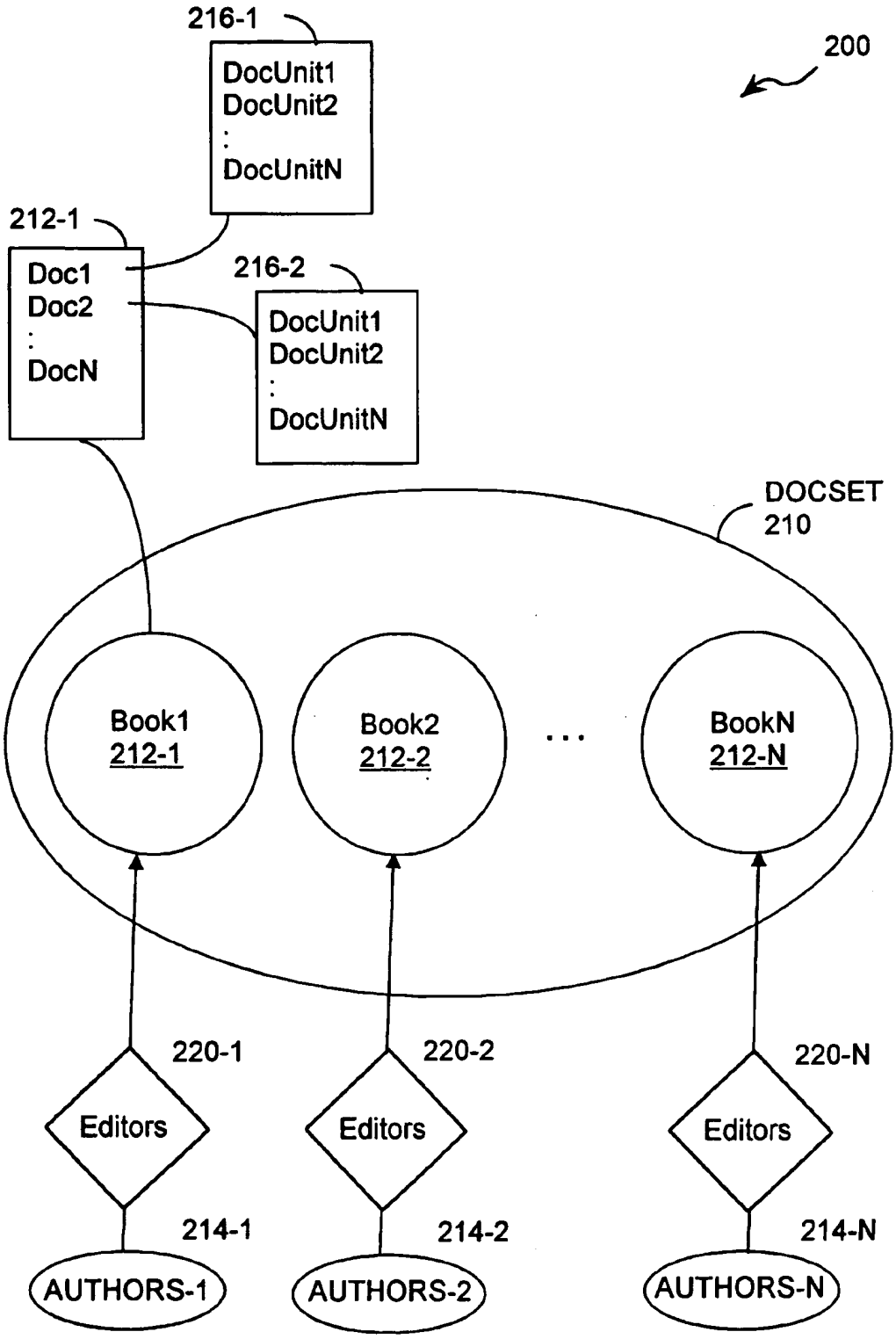

216-1
DocUnit1
DocUnit2
:
DocUnitN
200
212-1
Doc1
Doc2
:
DocN
216-2
DocUnit1
DocUnit2
:
DocUnitN
DOCSET
210
Book1
212-1
Book2
212-2
...
BookN
212-N
220-1
220-2
220-N
Editors
Editors
Editors
214-1
214-2
214-N
AUTHORS-1
AUTHORS-2
AUTHORS-N

FIG. 1

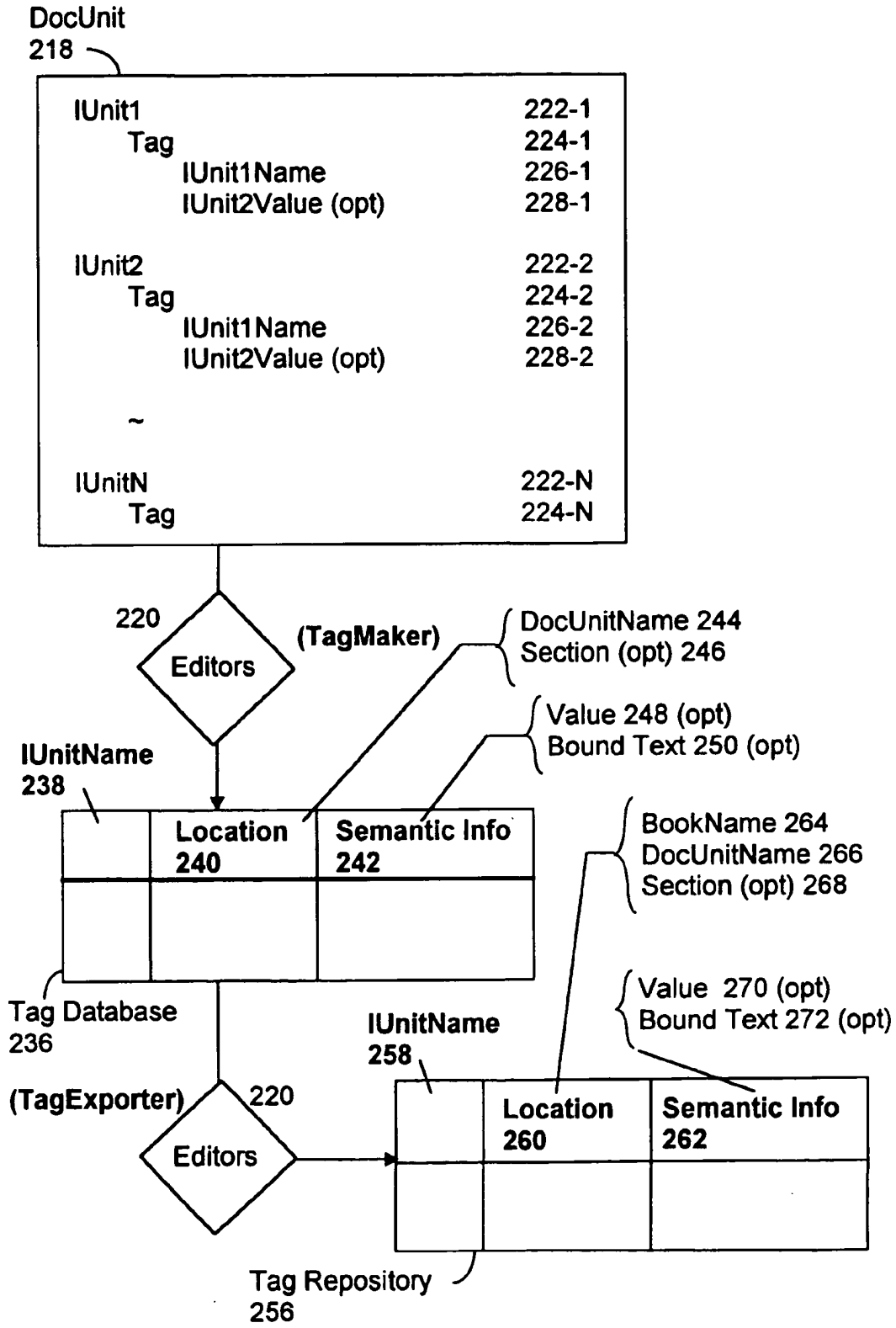

DocUnit
218
IUnit1 222-1
Tag 224-1
IUnit1Name 226-1
IUnit2Value (opt) 228-1
IUnit2 222-2
Tag 224-2
IUnit1Name 226-2
IUnit2Value (opt) 228-2
~
IUnitN 222-N
Tag 224-N
220
Editors
(TagMaker)
DocUnitName 244
Section (opt) 246
Value 248 (opt)
Bound Text 250 (opt)
IUnitName
238
Location
240
Semantic Info
242
BookName 264
DocUnitName 266
Section (opt) 268
Tag Database
236
Value 270 (opt)
Bound Text 272 (opt)
IUnitName
258
(TagExporter)
220
Editors
Location
260
Semantic Info
262
Tag Repository
256

FIG. 2

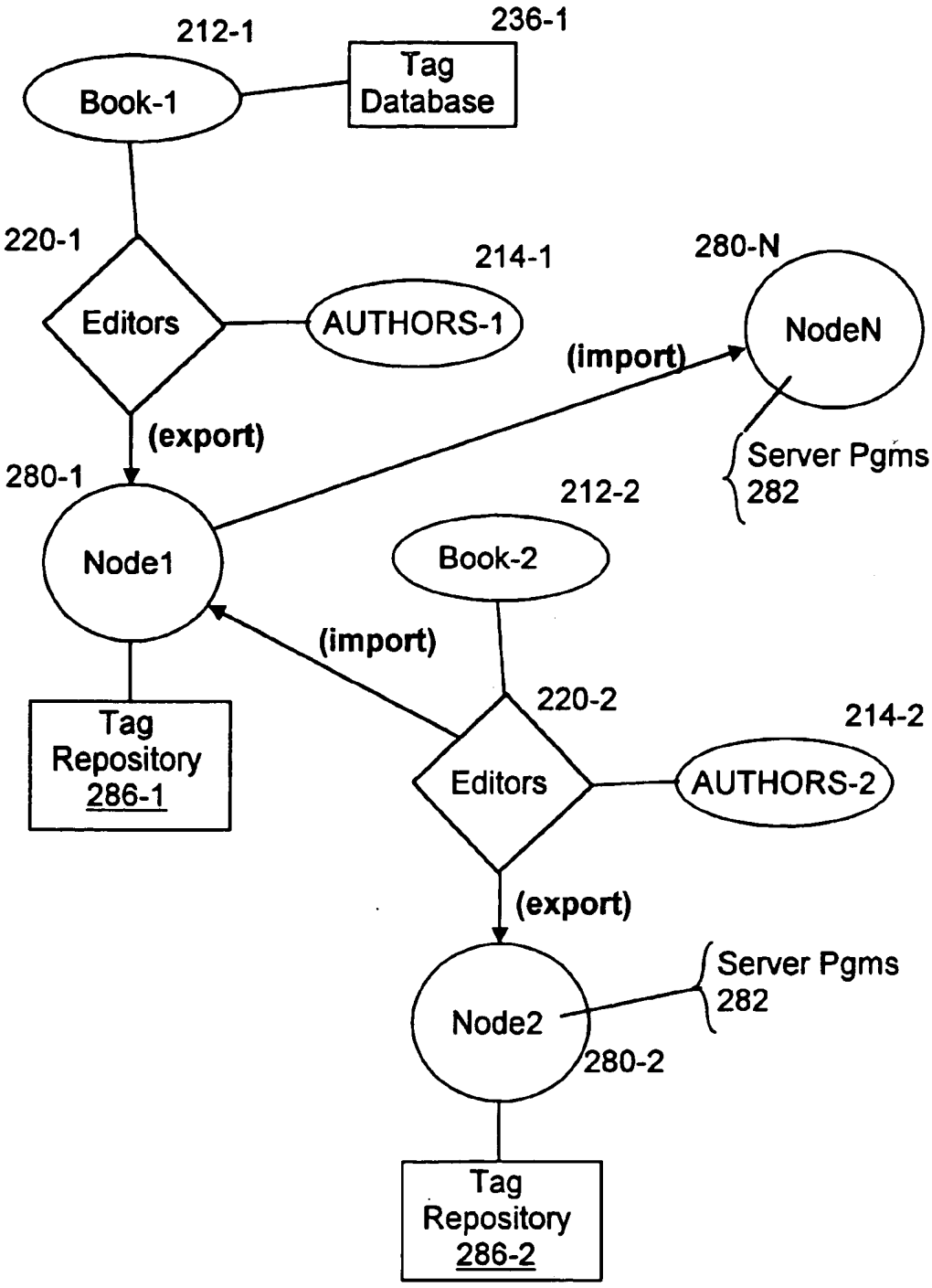

212-1
236-1
Book-1
Tag Database
220-1
214-1
280-N
Editors
AUTHORS-1
NodeN
(import)
(export)
Server Pgms 282
280-1
212-2
Node1
Book-2
(import)
220-2
214-2
Tag Repository 286-1
Editors
AUTHORS-2
(export)
Server Pgms 282
Node2
280-2
Tag Repository 286-2

FIG. 3

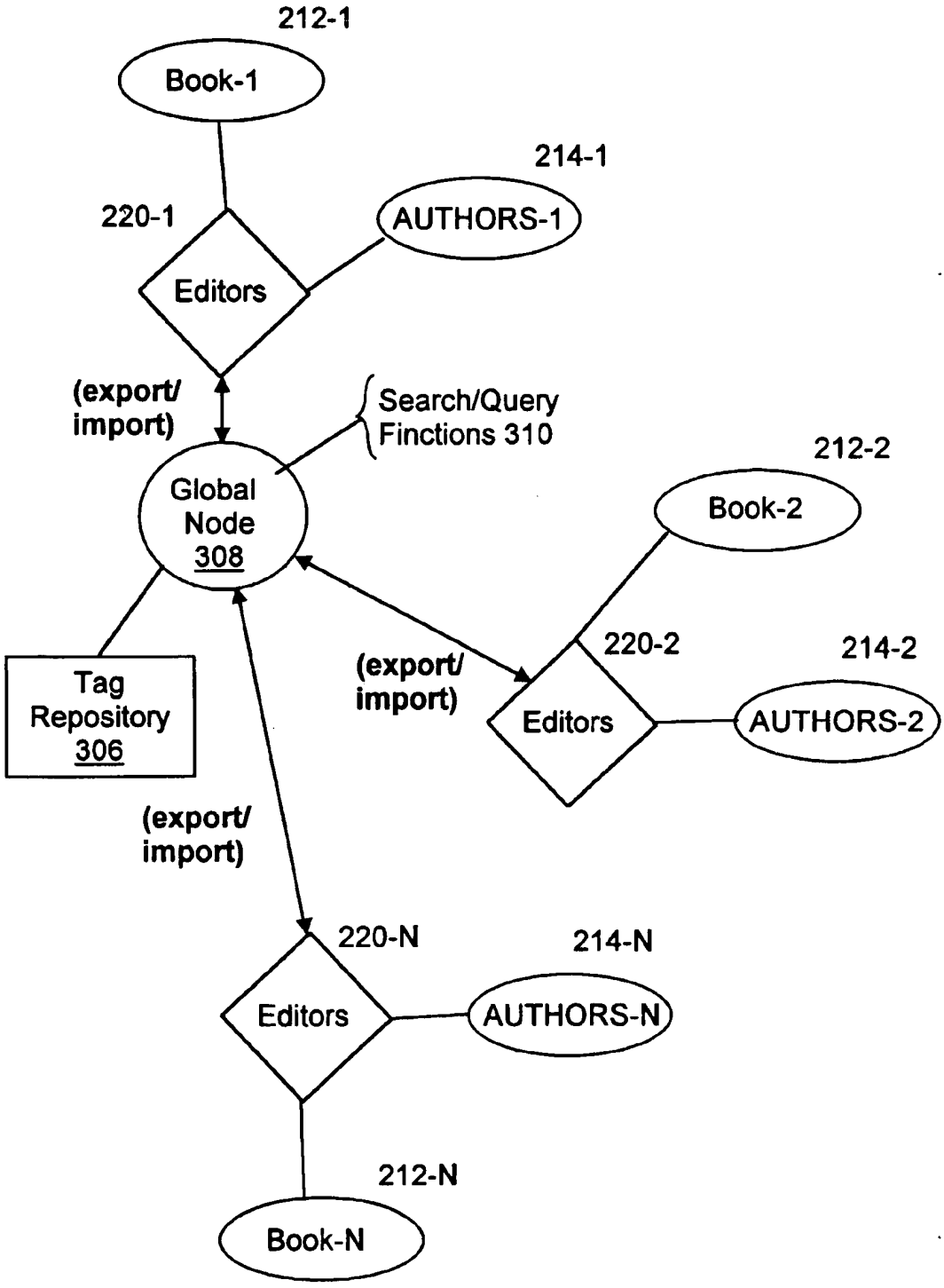

212-1
Book-1
214-1
220-1
AUTHORS-1
Editors
(export/
import)
Search/Query
Finctions 310
212-2
Global
Node
308
Book-2
220-2
214-2
Tag
Repository
306
(export/
import)
Editors
AUTHORS-2
(export/
import)
220-N
214-N
Editors
AUTHORS-N
212-N
Book-N

FIG. 4

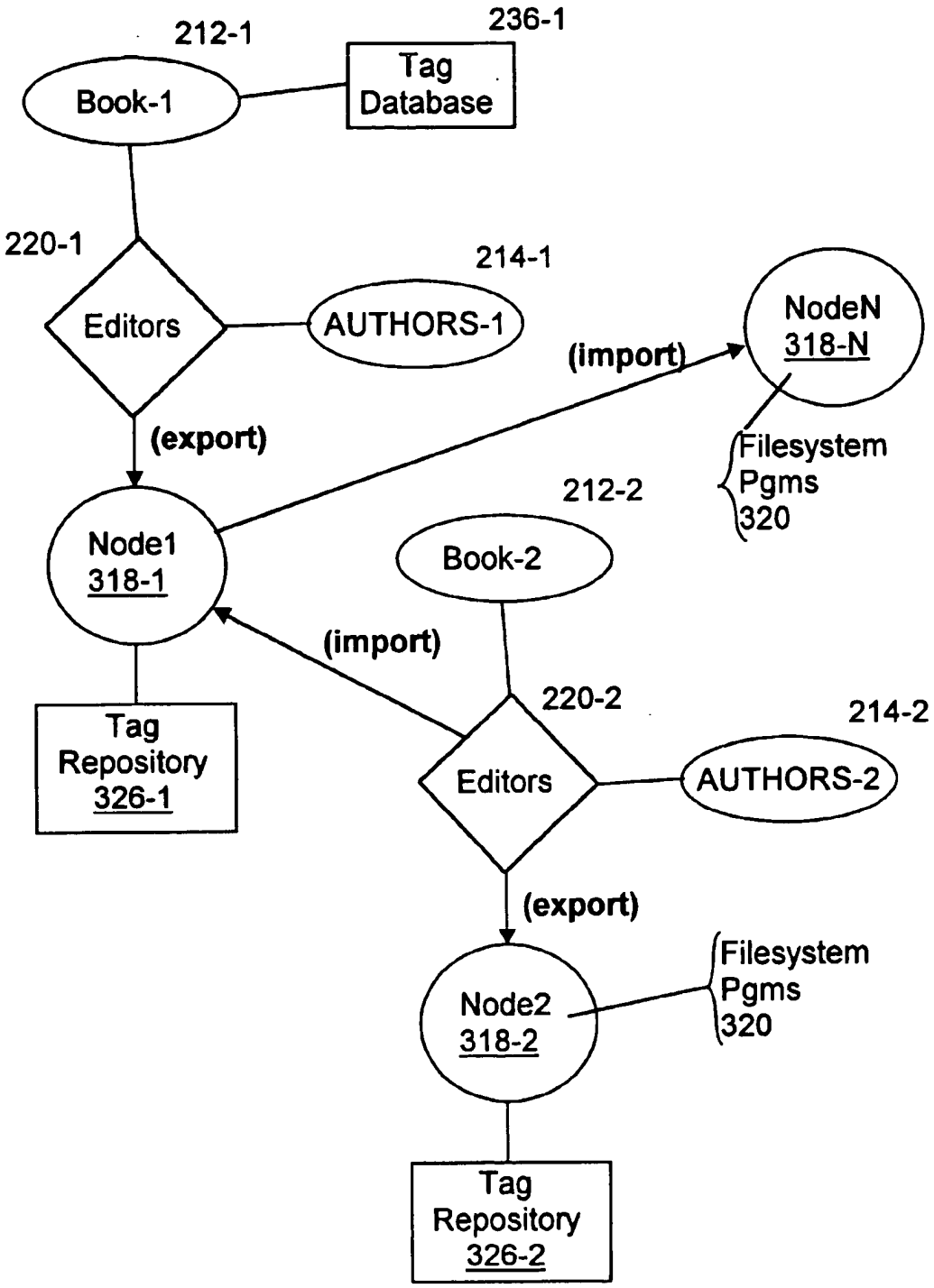

212-1
236-1
Book-1
Tag Database
220-1
214-1
Editors
AUTHORS-1
NodeN 318-N
(import)
(export)
Filesystem Pgms 320
212-2
Node1 318-1
Book-2
(import)
Tag Repository 326-1
220-2
214-2
Editors
AUTHORS-2
(export)
Filesystem Pgms 320
Node2 318-2
Tag Repository 326-2

FIG. 5

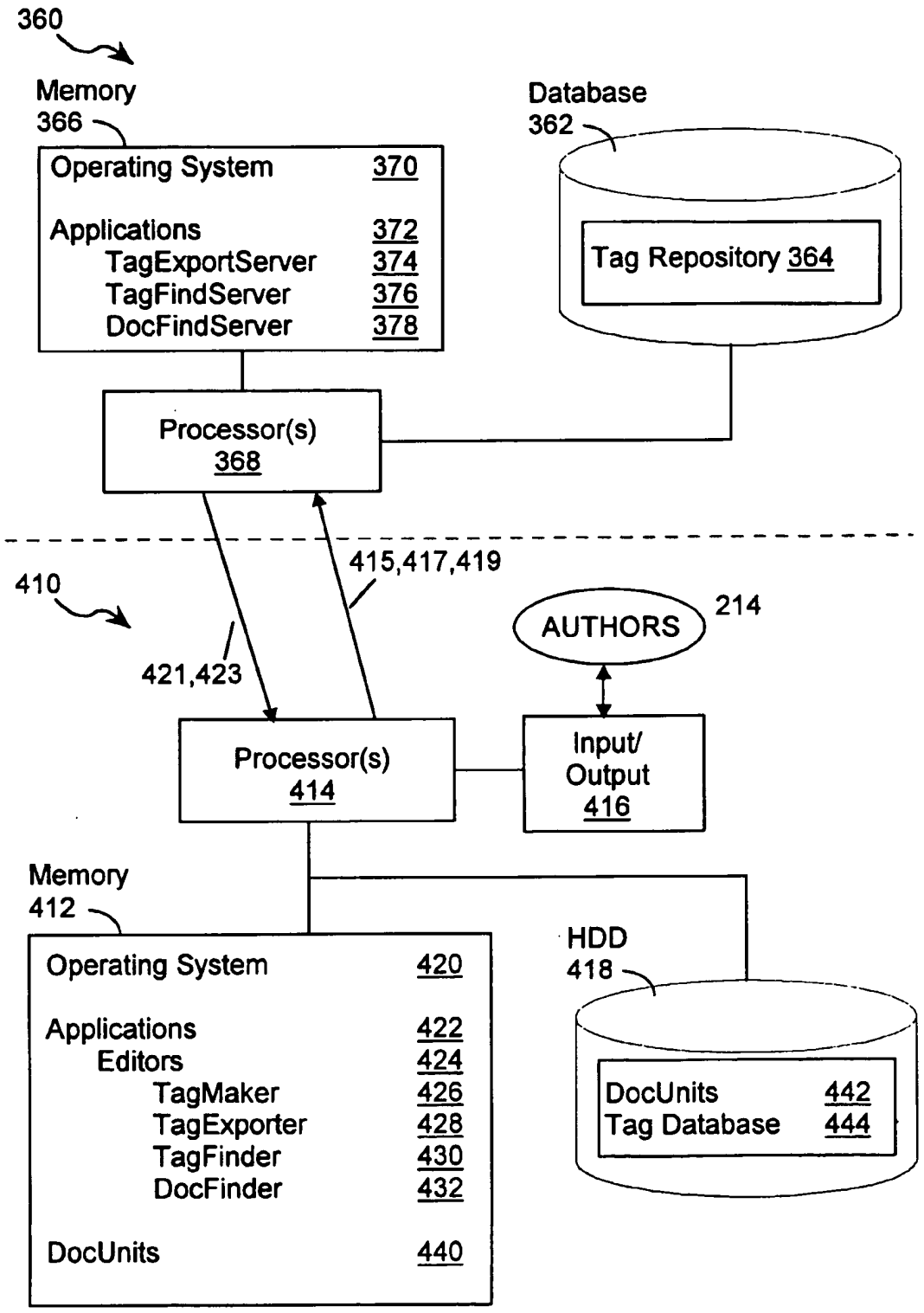

360
Memory
366
Operating System 370
Applications 372
TagExportServer 374
TagFindServer 376
DocFindServer 378
Database
362
Tag Repository 364
Processor(s)
368
415,417,419
410
421,423
AUTHORS
214
Processor(s)
414
Input/
Output
416
Memory
412
Operating System 420
Applications 422
Editors 424
TagMaker 426
TagExporter 428
TagFinder 430
DocFinder 432
DocUnits 440
HDD
418
DocUnits 442
Tag Database 444

FIG. 6

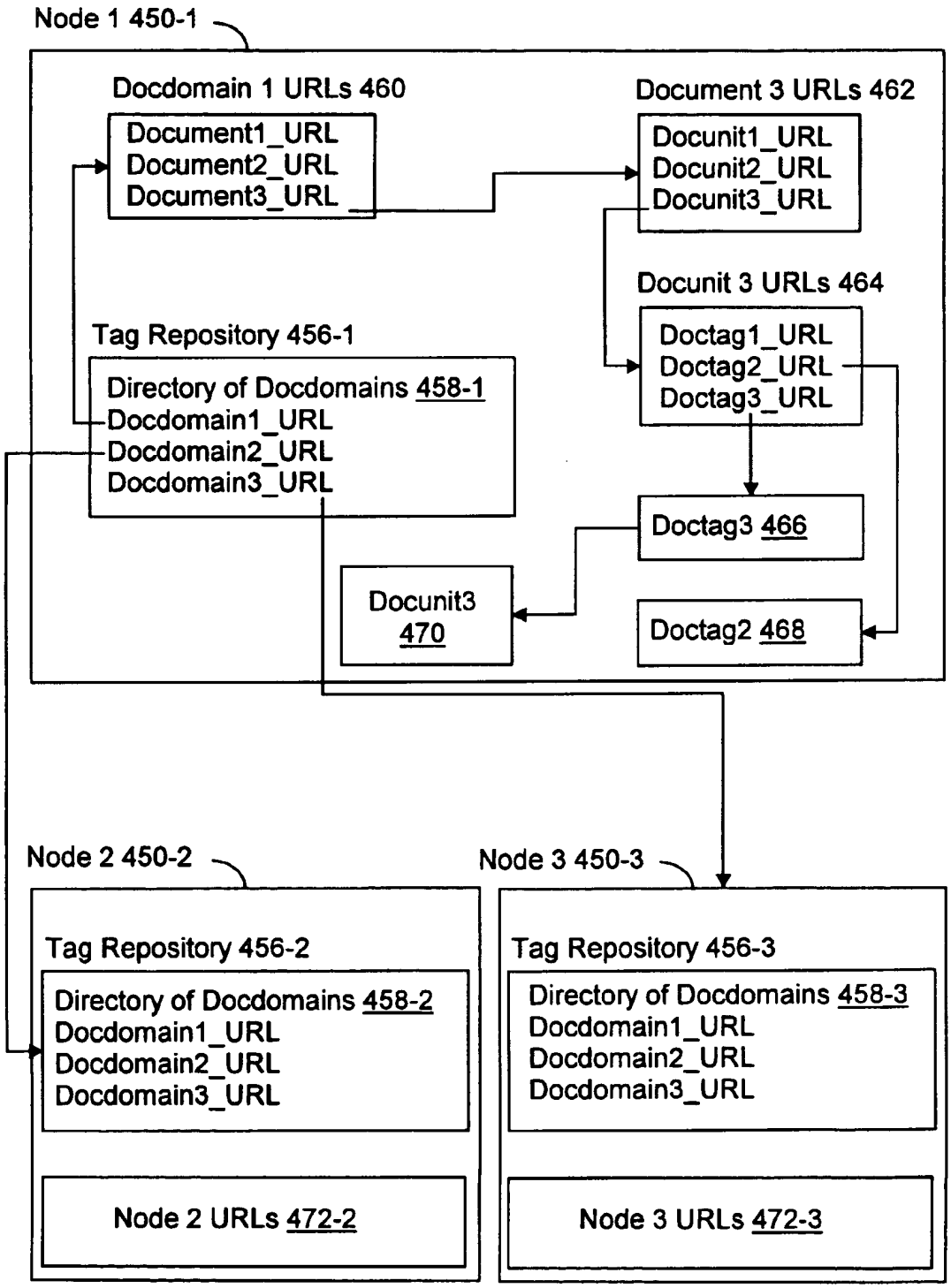

Node 1 450-1
Docdomain 1 URLs 460
Document1_URL
Document2_URL
Document3_URL
Document 3 URLs 462
Docunit1_URL
Docunit2_URL
Docunit3_URL
Docunit 3 URLs 464
Doctag1_URL
Doctag2_URL
Doctag3_URL
Tag Repository 456-1
Directory of Docdomains 458-1
Docdomain1_URL
Docdomain2_URL
Docdomain3_URL
Doctag3 466
Docunit3 470
Doctag2 468
Node 2 450-2
Node 3 450-3
Tag Repository 456-2
Directory of Docdomains 458-2
Docdomain1_URL
Docdomain2_URL
Docdomain3_URL
Node 2 URLs 472-2
Tag Repository 456-3
Directory of Docdomains 458-3
Docdomain1_URL
Docdomain2_URL
Docdomain3_URL
Node 3 URLs 472-3

FIG. 7

LINKING RELATED DATA IN A DOCUMENT SET INCLUDING A PLURALITY OF BOOKS WRITTEN BY DIFFERENT GROUPS OF AUTHORS IN A COMPUTER NETWORK

The present invention relates generally to document preparation systems and, particularly, to document preparation systems used to create sets of related documents.

BACKGROUND OF THE INVENTION

A document preparation project, such as writing the user manuals for the Unix operating system, can involve many authors collectively writing tens of manuals comprising thousands of pages. In such a project an author of one manual section often needs to reference or include in their section data or information from different sections and/or manuals.

In a conventional document preparation system an author needing to find such information must laboriously scan the other sections and/or manuals until they find the file that contains the desired information.

Once an author finds the desired information, they can employ one of many prior art mechanisms to incorporate the found information in the target document. For example, a hypertext link that references the desired information can be inserted into the target document that causes the linked information to be printed out whenever the target document is printed.

Today, this method is generally only possible when the link and the cross-referenced material are in the same manual. This method does not work in any commercially-available system when information needs to be accessed across multiple manuals. However, this too might also be possible given World Wide Web technology. As an alternative to automatic incorporation the author can simply copy the information into their own section.

The prior art document preparation methodology becomes unmanageably complex and inefficient when many authors from different groups and in different physical locations cooperate to write multiple manuals of a large product or project. Additional complexity is added when the documents are being written or updated concurrently, in which case the search for current or a correct version of the information to link could be never ending.

Generally, the cross-reference is limited to standard entities supported in the document preparation system, such as chapters, figures, sections, etc. An author might wish to import only a small part of another author's document that is not necessarily characterized as a standard textual unit (e.g., section, chapter, figure, table, list, etc.). For example, an author might want to import part of a phrase that specifies a value for a parameter that appears in more than one document. Using prior art mechanisms, such as tables of contents or indices, it would be difficult to provide meaningful information about such importable information that would enable the author to find it, let alone import it.

SUMMARY OF THE INVENTION

In summary, the present invention includes methods and protocols that enable efficient and seamless collaboration among multiple sets of authors of related documentation books in a documentation set wherein each book in a set written by multiple authors constitutes a single domain, and multiple of these domains consititute the documentation set such that each domain may be independently administered,

be geographically dispersed, be on different computer and operating systems, and be connected by either a corporate intranet, or the public internet, networking infrastructure.

In particular, the present invention is a method for linking data in a document set including a plurality of books written by different groups of authors. The first step involves an author of a first book tagging an information unit (iunit) in that book with a tag that provides information about the iunit, including a semantic attribute and a unique identifier. The author then exports the tag to a tag repository that is accessible to all groups of authors. An author of a second book can then access the tag repository and select a tag whose corresponding information they would like to import into the second book.

The semantic information is preferably a meaningful description provided by the author of the first book that is viewable and searchable in the tag repository to enable an iunit of a desired semantic type to be selected for importation into the second book.

The tag repository can be distributed across a plurality of networked nodes. In this embodiment the exporting step comprises exporting tags for a particular book to a respective tag repository located on a predetermined node and the selecting step comprises selecting relevant tags from among all of the tag repositories.

The tag repository can also be distributed across a plurality of networked nodes running a filesystem. In this case the exporting step comprises creating a common, shared directory including the tags for all of the books and the selecting step then comprises selecting relevant tags from the common directory using utilities provided by the filesystem.

Alternatively, the tag repository can comprise a single, global tag repository stored on a single computer and accessed through network protocols such as HTTP (hypertext transfer protocol), in which case the access could be from an HTML-based browser.

In another embodiment the tag repository can be distributed across multiple computers that permit access to the tags through a variety of means, such as Web browsers, remote procedure calls (RPC) and client-server engines.

The present invention also includes systems that perform the methods and protocols described above.

BRIEF DESCRIPTION OF THE DRAWINGS

Additional objects and features of the invention will be more readily apparent from the following detailed description and appended claims when taken in conjunction with the drawings, in which:

FIG. **1** is a diagram of a document preparation system in which the present invention is implemented;

FIG. **2** is a data flow diagram illustrating the operation of a generic document unit **218** (DocUnit) of FIG. **1**;

FIG. **3** is a block diagram of a preferred embodiment of the present invention that employs a distributed tag repository;

FIG. **4** is a block diagram of a preferred embodiment of the present invention that employs a global tag repository;

FIG. **5** is a block diagram of a preferred embodiment of the present invention that is implemented on a computer network wherein the nodes are linked and are running a filesystem;

FIG. **6** is a block diagram of a computer system in which the present invention is implemented; and

FIG. 7 is a block diagram of a preferred embodiment of the present invention that is implemented on a computer network in which addressing is URL-based and wherein the tags are maintained in HTML files and accessed through Web browsers.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The following glossary defines terms that are used throughout the description.

Glossary of Terms

iunit	a unit of information in a Docunit that is identified by a property-value pair in the Doctags;
Docunit	a unit of documentation mapped to a single file;
Document	a collection of one or more Docunits;
Doc-domain	a self-contained unit of document administration with one or more authors generating one or more Documents (for the purposes of the present discussion, Docdomains are also referred to as Books;
Docset	a collection of one or more Docdomains
Doctags	a collection of one or more tags in a Docdomain that export pointers to iunits from Documents in their Docdomain to other Docdomains;
tagfinder	a software function that parses the Doctags database and finds a pointer to the requested information based on some user specified search function;
tagmaker	a software function that parses the Docunit to generate a Doctags database for that document;
URL	Universal Resource Locator, a file/resource address used on the Internet and intranets of the form: communications protocol. domain name. file/resource identifier).

Referring to FIG. 1, there is shown a depiction of a document preparation system **200** in which the present invention is implemented. The system **200** is used to prepare a document set **210** that includes one or more books **212**. For example, the document set **210** could comprise the documentation for a particular computer system, in which case respective books **212** might describe the computer system's operating software, programming tools, system utilities, processor architecture and communications capabilities.

Each book **212-1, 212-2, 212-N** is created and/or updated by a set of authors **214-1, 214-2, 214-N** using word processors/editors **220-1, 220-2, 220-N**. A book **212** comprises one or more documents **216**, each of which is subdivided into one or more physical files/document units **218** (hereinafter referred to as "docunits"). A book author **214** creates or updates a book **212** by editing a docunit **218** with one of the editors **220**.

An editor **220** can be any document editor/word processor (past, present or future) that has been modified in accordance with the teachings of the present invention to facilitate the linking of information between the different books **212-1, 212-2, 212-N**. When the editor **220** is conventional, the computers on which the document preparation system **200** is executed must include software functions that perform at least a subset of the various information linking operations prescribed by the present invention. In such a case the software functions operate on the documents generated by the various editors **220**. In the following discussions of the preferred embodiments it is assumed that the editors **220** are configured to implement at least a subset of the prescribed software functions.

In a document preparation environment **200** such as that depicted in FIG. **1** there is likely to be at least some duplication of information among at least a subset of the books **212**. For example, the aforementioned docset **210** for a computer system might include books **212-1, 212-2** that describe the operating system at different levels of detail (e.g., a programmer's reference and a high-level user summary) and include common information, such as lists of operating system commands.

The present invention enables authors **214** to find and create links to information in other books **212** so that the common information need only be generated and maintained by the original set of authors **214**. As a first step in the linking process authors **214** of a book **212** designate, or tag, information units (hereinafter, "iunits") within a docunit **218**. After tagging, the creating authors export the tagged iunits to a tag repository, from which other authors may then import the exported tags. Following exporting, the tag repository includes pointers to the just-exported iunits in the docunit **218**. The tag repository can include pointers to iunits exported from any or all of the books **212**.

Authors **214** select from the repository iunits they wish to import into docunits **218** for their own books **212**. The present invention enables authors to define tagged iunits at any document level (e.g., an entire docunit, a section of a document, a single word, etc.). As described in reference to FIGS. **3–5**, the present invention can make the tagged iunits **222** accessible to all of the authors **214** regardless of whether the respective books **212** are stored on a single computer or distributed across a network of computers. The processing flow of the present invention that makes this possible is now described in reference to FIG. **2**.

Referring to FIG. **2**, there is shown a data flow diagram that illustrates how the present invention transforms tagged iunits **222** within a docunit **218** into a local tag database **236** and a tag repository **256**. For the purposes of this discussion it is assumed that the generic docunit **218** includes one or more iunits **222** that have been marked for export with a respective tag **224**. Each tag **224** designates the iunit name **226** and, optionally, the iunit value **228**. The docunit **218** also includes other standard document elements that are not shown in FIG. **2**.

For example, consider the docunit, "foo.bar", shown in Table 1:

TABLE 1

```
<group> atm_group
    <docunit> foo.bar
        <section> "Switch Weight"
            ~
            <figure> "Switch Schematic"
                ~
            <p> The weight of the matrix switch is <iutag> 10 tons
            iunit="matrix switch" value="weight" <eiutag>
            <p>
        <esection>
    <edocunit>
<egroup>
```

The docunit, "foo.bar", is a file within the "atm_switch" group/book/docdomain ("atm" is an abbreviation for asynchronous transfer mode). Table 1 represents the contents of the file, "foo.bar", in a generic markup language that is similar to GML™. The present invention is equally applicable to other types of document preparation systems, including WYSIWYG word processors, and is independent of any specific file format (e.g., the file may be an HTML file or any other type file). In Table 1 document elements (e.g., sections, figures, paragraphs) are delineated using mnemonics that are set off by matched sharp brackets "<" ">" and sometimes followed by a series of descriptors (e.g., "<section>"). Some of the mnemonics have a corresponding end mnemonic (e.g., "<esection>"). Thus, Table 1 includes a document section entitled "Switch Weight" (<section>

"Switch Weight") that includes standard elements such as a figure showing a switch schematic (<figure> "Switch Schematic") and paragraphs (set off by <p>).

The present invention enables an author to mark phrases or paragraphs for export by assigning them an export property and then giving the property an optional value. In the preferred embodiment, this is done using iunit tags. For example, the following markup from Table 1:

<p> The weight of the matrix switch is <iutag> 10 tons iunit= "matrix switch" value="weight" <eiutag>

defines the export property "matrix switch", assigns it the value "weight" and binds that value to the text "10 tons". The author of the original foo.bar docunit can then choose to export information about the "matrix switch" iunit along with any other tagged iunits. Using the exported "matrix switch" iunit information, other authors of other books that need to refer to the specific switch weight defined in the foo.bar docunit can then locate that information easily via the exported "matrix switch" tag. Thus, the present invention enables a reference/tag to be created to a document element (e.g., "10 tons") that includes the necessary information to allow another author to find the element and to create a reference to it after the tag has been exported. It is described below how the iunit information from the docunit **218** is exported and selected by other authors.

Referring again to FIG. **2**, in the preferred embodiment whenever a docunit **218** is updated using the editor **220**, the editor **220** executes a TagMaker program that scans the docunit **218** and generates/updates the tag database **236** from all of the exportable information within the docunit **218**. The exportable information includes at least a subset of the standard document elements and the iunits that were tagged for export. In the preferred embodiment, there is one tag database **236** per book **212** (FIG. **1**).

The tag database **236** includes for each iunit **222** an iunit name (IUnitName) **238**, iunit location information (Location) **240** and, optionally, semantic information (Semantic Info) **242**. The location information **240** specifies the docunit name **244** and, optionally, the section **246** in which the corresponding iunit **222** is found. The optional semantic information **242** indicates the value **248** of the iunit **222** and the document element **250**, if any, that is bound to the iunit **222**. For example, Table 2 shows the tag database entry that might be generated by the TagMaker from the "matrix weight" iunit defined in Table 1.

TABLE 2

iunit = "matrix switch"
"weight" = "@byte offset into the file pointing to 10 tons, num_bytes=7"
"DocUnitName = "foo.bar"
"section" = "Switch Weight"

The first row of Table 2 indicates that this tag database entry is for the iunit, "matrix switch". The second row equates the value ("weight") of "matrix switch" with a pointer to the position in the "foo.bar" docunit/file that includes the particular occurrence of "10 tons" to which "weight" was bound and the number of bytes (7) of the referenced text. In Table 2, the pointer is shown as an unspecified offset in bytes ("@byte offset") from the beginning of the "foo.bar" file. In practice, this value would be definite. Any other pointer implementation can be used as long as it can uniquely reference the bound text. Alternatively, the referenced text can be incorporated as a string; e.g., weight="10 tons".

Note that the information in the tag database **236** can be represented in any format and that the information shown in Table 2 represents only a partial (i.e., neither maximum or minimum) set of the information that can be included in the tag database **236**. For example, the tag database **236** might also indicate the book (or docdomain) **212** that encompasses the foo.bar docunit. Alternatively, if a section is not defined in the docunit **218**, the section information **246** would not be included in the tag database **236**.

In the preferred embodiment, the TagMaker is also configured to generate automatically tag database entries for a selectable subset of the structural elements from the docunit **218**. Typically, the exportable structural elements include figures, tables, sections, chapters, etc., although other elements can also be exported. These elements are typically defined using commands provided by the editors **222**. Thus, less information is needed in the tag database **236** to provide an unambiguous link to these elements. For example, Table 3 shows how the "Switch Weight" section might be referenced in the tag database **236**.

TABLE 3

iunit = :section. "Switch Weight"
DocUnitName = "foo.bar"

The first line of this tag database entry identifies the iunit by its structural type (":section.") and name ("Switch Weight"). The second line indicates the name ("foo.bar") of the DocUnit that includes the iunit.

As the docunits **218** that compose a book **212** are updated and the TagMaker is executed, the tag database **236** grows to reflect all of the exportable iunits within the docunits that compose that book **212**. The tag database **236** is available to all authors **214** of the book **212**. However, until it has been exported to the global tag repository **256**, the information in the tag database **236** cannot be referenced by the other authors **214**.

In the preferred embodiment, the tag database **236** is exported by a TagExporter that is invoked from with the editors **220** or from some other program. The TagExporter exports the information in the tag database **236** to the tag repository **256**.

Like the tag database **236**, the tag repository **256** includes for each iunit **222** an iunit name (IUnitName) **258**, location information (Location) **260** and, optionally, semantic information (Semantic Info) **262**. The location information **260** specifies the book **264**, docunit **266** and, optionally, the section **268** in which the corresponding iunit **222** is found. The semantic information **262** indicates the value **270** of the iunit **222** and the bound text **272**, if any. For example, Table 4 shows the tag repository entry that might be exported by the editor **220** from the "matrix weight" iunit defined in Table 1.

TABLE 4

iunit = "matrix switch"
"weight" = "@byte offset into the file pointing to 10 tons, num_bytes=7"
"DocUnitName = "foo.bar"
"section" = "Switch Weight"
"DocDomain" = "atm_group"

The information in the tag repository **256** is viewable and searchable. An author **214** can find iunits to import using a TagFinder program that searches for a particular iunit (or sets of iunits) in the tag repository **256** and returns to that author the corresponding link data. Once in possession of the link data, the author **214** can import the selected iunit by reference (such as a citation), or by inclusion in a target

docunit **218**. It is immaterial to the present invention what particular technology is used to import an iunit into the target docunit **218**.

In some situations, an author **214** may wish to import an entire docunit **218**, not just an iunit **222**. In this case the author can execute a DocFinder program that searches for a designated docunit(s) and returns link information for the docunit(s) in the same manner as the TagFinder.

The manner in which the tag repository **256** is implemented depends largely on the architecture of the document preparation system **200**. Three different architectures and corresponding tag repository implementations are now described in reference to FIGS. **3–5**.

Referring to FIG. **3**, there is shown a document preparation system wherein the tag repository is distributed over several networked nodes **280**. In this system sets of authors **214** employ respective editors **220** to create and edit a respective book **212**. The books **212** compose the docset **210**. As described in reference to FIG. **2**, each time one of the authors **214** updates one of the docunits **218** in the book **212** the tag database **236** is updated by the TagMaker with link information for all of the exportable iunits **222**. In this embodiment the information in the tag database **236** is exported to a corresponding tag repository **286** hosted on a respective network node **280**. Authors **214** import iunits **222** from different books **212** by issuing TagFind requests. A TagFind request results in the execution of the TagFinder program, which, in this system architecture, is configured to (1) visit each of the distributed tag repositories **286** in search of the desired iunits and (2) return any relevant link information to the requester. In the preferred embodiment, each node **280** that hosts one of the pieces of the distributed tag repository **286** includes server programs **282** that provide access to that piece. These server programs respond to search requests issued by the TagFinder.

Referring to FIG. **4**, there is shown a document preparation system wherein the tag repository is implemented as a single, global repository. In the system of FIG. **4** the authors **214** update and edit the docunits composing their respective books **212** as described in reference to FIG. **3**. The respective tag databases **236** (not shown) are also updated as described in reference to FIG. **3**. All information exported from the tag databases is exported to a central tag repository **306** hosted on a global node **308**. The global node **308** is accessible to all authors **214**. Preferably, the tag repository **306** is implemented as a database that is accessed using search/query functions **310** provided by the global node **308**. The query functions **310** are invoked in response to the TagFind requests issued by the various authors and return links to the authors as described in reference to FIG. **3**.

Referring to FIG. **5**, there is shown a document preparation system wherein the tag repository is implemented on a computer network whose nodes **318** are linked and are running filesystem software **320**. The filesystem **320** may be a global filesystem, such as afs™; an intra-networked filesystem, such as nfs™ or a clustered filesystem. The filesystems generally allow transparent access to any file within their purview and, hence, the iunits or docunits are accessible uniformly to any programs or users. The TagMaker, TagFinder, DocFinder programs, etc. can easily make use of this transparency and can be implemented to access the linked information via normal filesystem operations.

In this system, the books **212** and tag databases **236** are updated and managed as in the embodiments of FIGS. **3** and **4**. Tag repository segments **326** are stored as files on the networked nodes **318**, some of which also host a respective book **212**. Due to the filesystem **320**, the iunit information in the repository segments **326** is visible to all authors **214** as separate files in a common, shared directory. An author **214** selects an iunit by simply copying the corresponding file into the target docunit. The

TagFinder/DocFinder can search the common, shared directory using any of the file search utilities provided by the filesystem **320**. As in the other embodiments, an author who imports an iunit can choose to import the iunit by reference or by inclusion.

Referring to FIG. **6**, there is shown is a block diagram of a computer system in which the present invention is implemented. This system is modeled on the document preparation system of FIG. **4**, which incorporates a global tag repository. The dashed line in FIG. **5** separates a computer **360** that hosts the global tag repository **362** from a computer **410** used by a set of authors **214** to create a book **212** and its associated docunits **222**.

The computer **410** includes a fast memory (such as a random access memory RAM) **412**, one or more processors **414**, a user interface **416** and a larger, slower memory (such as a hard disk drive—HDD) **418**. In the conventional manner, application programs **422** are executed by the processor **414** in the memory **412** under control of the operating system **420**. The application programs **422** include one or more editors **424**, each of which, in accordance with the preferred embodiments, incorporate at least a subset of the software support functions prescribed by the present invention. As described above, these software support functions include the TagMaker **426**, the TagExporter **428**, the TagFinder **430** and the DocFinder **432**. The memory **412** also includes at least a portion of any docunit **440** that is being edited using the editor **422**.

The HDD **418** permanently stores docunits **442** and, optionally, a local tag database **444**. The authors **214** interact with the computer **410** through input/output devices **416**.

Given this configuration, anytime a user updates a docunit the editor **424** executes the TagMaker **426**, which updates the local tag database **444**. When an author executes the TagExporter **428**, that program exports information **415** from the tag database **444** to the computer **360**. When an author **214** executes the TagFinder **430** or the DocFinder **432**, corresponding requests **417**, **419** are issued to the computer **360**, which returns information regarding the existence of a pointer to the requested iunit or docunit.

The computer **360** includes a memory **366**, one or more processors **368** and a database **362** that hosts the tag repository **364**. The computer **360** operates conventionally. That is, the processor **368** executes application software **372** in the memory **366** under the control of the operating system **370**. The application software **372** includes server routines **374**, **376**, **378** that enable the computer **360** to respond, respectively, to exported information **415** and TagFind and DocFind requests **417**, **419**, from the computer **410**. The TagExportServer **374** writes the exported information **415** to the tag repository **364** using whatever language is supported by the database **362**. The TagFindServer **376** issues database queries to the database **362** to find the iunits specified by the TagFind request **417** and returns link information **421** for those iunits to the computer **410**. The DocFindServer **378** issues database queries to the database **362** to find the docunits specified by the DocFind request **419** and returns link information **423** to the computer **410** for those docunits.

The preferred embodiments of FIGS. **3** and **5** are implemented mostly as described above in reference to FIG. **6**. Any differences in implementation follow from differences in the respective document preparation system architectures.

For example, the implementation of the embodiment of FIG. 3 is like that of FIG. 4, except that there are a plurality of computers that perform the functions of the computer 360 (FIG. 6). For the embodiment of FIG. 5, in lieu of the TagMakeServer, TagFindServer and DocFindServer programs, the plurality of computers hosting the various tag repositories each run the various programs that constitute the filesystem.

Referring to FIG. 7, there is illustrated another preferred embodiment that employs URLs to export doctags and to import linked information into other documents. This embodiment can be structured similarly to either FIG. 4 or FIG. 5; i.e., it can utilize a distributed or a single tag repository. For the purposes of the present discussion the tag repository is assumed to be distributed. Each docdomain (or book) has a global URL (Docdomain_URL) associated with it at the time the docdomain it is defined. The Docdomain_URL for each docdomain is made well known to all of the docdomains within the docset. Each Docdomain_URL points to a file that lists the URLs (Document_URLs) for each of the documents that compose that docdomain. Each Document_URL in turn points to a file that lists the URLs (Docunit_URLs) for each docunit in that document and each Docunit_URL points to a file that contains one Doctag_URL for each doctag in that docunit.

For example, referring to FIG. 7, there is shown a collection of networked nodes 450-i (i being 1, 2 or 3), each hosting a respective docdomain (note that all of the docdomains could also be hosted on the same node). Each node 450-i includes a tag repository 456-i that includes, among other things, a directory 458 of Docdomain_URLs for all of the docdomans in the docset. In this example the docset includes three docdomains, therefore each tag repository 456 has a directory 458 with three Docdomain_URLs.

The tag repository 456-1 for an exemplary node 1 includes a Docdomain1_URL pointer that points to a top-level file 460 that includes Document_URLs for each of the 3 documents that make up docdomain 1. For example, the Document3_URL points to a file 462 that includes Docunit_URLs for each of the three docunits that make up document 3. Details are shown for the Docunit3_URL from the file 462, which points to a file 464 that includes URLs for each of the three doctags defined in the docunit 3, which are stored as individual files; e.g., the files Doctag3 466 and Doctag2 468. As described above, a doctag file (e.g., Doctag3 466) can include a pointer to its associated docunit (e.g., the Docunit3 470) or can simply include a copy of its linked iunit information (e.g., Doctag2 file 468).

Thus, when the tagmaker is executed, each new doctag is assigned a URL and this URL is added by the tagmaker to the file identified by the Document_URL. Similarly, when a new document is created, the tagmaker adds that document's Document_URL to the file 460 identified by the respective Docdomain_URL.

The Docdomain_URL file 460 contents are kept locally at the site that is the "owner" of that Docdomain. For example, the contents of the Docdomain 1 file 460 are all kept on the node 450-1. The tagmaker does not export any of the tags outside the Docdomain. Instead, other authors reference the contents of a respective Docdomain_URL file by pointing the tagfinder to a corresponding Docdomain_URL. Docdomains are easily located as each distributed site keeps a list of all of the Docdomain URLs corresponding to the docdomains of a particular docset. For example, referring to FIG. 7, all of the tag repositories 456 hold the URLs of the top-level docdomain files, such as the Docdomain URL file 460.

In a preferred embodiment of a document preparation system configured to work with URLs a menu item is provided that invokes the tagfinder. When invoked, the tagfinder shows the contents of the docset hierarchically by accessing each Docdomain_URL and its constituents. This mode of operation can be achieved with conventional Web browsers, which display documents comprising many subdocuments by automatically retrieving each subdocument pointed to by a parent document.

Once a doctag of interest is located, its associated information unit (iunit) can be incorporated in one of two ways into the importing document. Either of these methods can be employed in any of the described embodiments.

In a first method the linked iunit is incorporated by reference. Then, at the time of printing, or when an index or cross reference listing is to be generated for the document, the doctag reference is resolved by the document preparation system software and the actual iunit value (as defined in the doctag) is pulled into the document to replace the reference for an appropriate duration. In other words, if the document preparation system is generating a cross reference listing, it merely uses the value without inserting it into the document. On the other hand, if the document preparation system is printing the document using a postscript process, it would incorporate the iunit value in the corresponding postscript file but not the source document.

In a second method the linked iunit is incorporated by copying the iunit value into the document itself. In this case the reference is resolved and the value in the iunit property-value pair replaces the reference in the document. In this embodiment if the iunit is updated the copy is unaffected. The only way such a copy can be updated is if the importing user runs an automatic tag update function, in which case some or all of the linked iunit values are updated as appropriate.

While the present invention has been described with reference to a few specific embodiments, the description is illustrative of the invention and is not to be construed as limiting the invention. Various modifications may occur to those skilled in the art without departing from the true spirit and scope of the invention as defined by the appended claims.

What is claimed is:

1. A method performed on a computer for linking data in a document set including a plurality of books, comprising the steps of;

tagging an information unit (iunit) from a first book with a tag that provides information about the iunit that includes a semantic attribute and a unique identifier;

exporting the tag to a tag repository; and

selecting the tag from the tag repository to request importation of the iunit to a second book.

2. The method of claim 1, wherein the exporting step is only performed by an author of the first book.

3. The method of claim 1, wherein the semantic information comprises a meaningful description provided by an author of the first book, the semantic information being viewable and searchable in the tag repository to enable an iunit of a desired semantic type to be selected for importation in the selecting step.

4. The method of claim 3, wherein each book has a respective set of authors and comprises a self-contained unit of document administration.

5. The method of claim 4, wherein each book comprises at least one document, each including one or more document units.

6. The method of claim 5, wherein each document unit corresponds to a respective computer file.

7. The method of claim 6, wherein the identifier uniquely identifies the document unit, document and book with which the iunit is associated.

8. The method of claim 7, wherein the tag is stored in a doctag file addressed by an associated doctag URL; such that the iunit is accessed for importation to the second book via the doctag URL.

9. The method of claim 8, wherein the doctag file is stored on a network node that hosts the first book.

10. The method of claim 9, wherein the network node comprises:

a set of document URLs;

each of the document URLs being associated with a respective document within the first book and identifying a second file including a list of docunit URLs, each of which is associated with a respective docunit included within the respective document; and

each of the docunit URLs identifying a respective third file including a list of the doctag URLs associated with respective doctag files included within the respective docunit.

11. The method of claim 10, wherein:

the tag repository comprises a list of domain URLs, each identifying a respective fourth file including the set of document URLs associated with documents composing a corresponding book within a document set; and

the network node comprises:

one copy of the tag repository; and

the second, third, and fourth files associated with the book hosted on that node.

12. The method of claim 7, wherein the iunits associated with a particular book are stored across at least one networked node.

13. The method of claim 4, wherein the tag repository comprises a single, global tag repository stored on a single computer.

14. The method of claim 4, wherein:

the tag repository is distributed across a plurality of networked nodes;

the exporting step comprises exporting tags for a particular book to a respective tag repository located on a predetermined node; and

the selecting step comprises selecting relevant tags from among all of the tag repositories.

15. The method of claim 4, wherein:

the tag repository is distributed across a plurality of networked nodes running a filesystem;

the exporting step comprises creating a common, shared directory including the tags for all of the books; and

the selecting step comprises selecting relevant tags from the common directly using utilities provided by the filesystem.

16. The method of claim 4, further comprising the step of:

updating a respective tag database for the book every time the book is updated; wherein the updating step comprises writing new entries to the tag database for each new tagged iunit and updating existing entries in the tag database as required;

wherein the exporting step comprises exporting information about new and updated entries in the tag database to the tag repository.

17. The method of claim 16, wherein the selecting step comprises:

accessing, upon request of an author of the second book, all tag repositories associated with the document set; and

selecting tags from the accessed tag repositories corresponding to the iunits to be imported from the first book.

18. The method of claim 17, further comprising the step of importing the iunit into the second book.

19. The method of claim 18, wherein the step of importing the iunit is selected from importing the iunit by reference or importing the iunit by inclusion.

20. A computer based band system for linking data in a document set including a plurality of books, comprising:

a tag that provides information about an information unit (iunit) from a first book, including a semantic attribute and a unique identifier;

a tagexporter configured to export the tag to a tag repository; and

a tagfinder configured to select the tag from the tag repository and import the iunit to a second book.

21. The system of claim 20, wherein the tagexporter is controlled only by an author of the first book.

22. The system of claim 21, wherein the semantic information comprises a meaningful description provided by an author of the first book, the semantic information being viewable and searchable in the tag repository to enable an iunit of a desired semantic type to be selected for importation in the selecting step.

23. The system of claim 22, wherein each book has a respective set of authors and comprises a self-contained unit of document administration.

24. The system of claim 23, wherein each book comprises at least one document, each including one or more document units.

25. The system of claim 24, wherein each document unit corresponds to a respective computer file.

26. The system of claim 25, wherein the identifier uniquely identifies the document unit, document and book with which the iunit is associated.

27. The system of claim 26, wherein the tag is stored in a doctag file with an associated doctag URL; such that the tagfinder is configured to access the identifier for importation of the iunit into the second book via the doctag URL.

28. The system of claim 27, wherein the doctag file is stored on a network node that hosts the first book.

29. The system of claim 28, wherein the network node comprises:

a set of document URLs;

each of the document URLs being associated with a respective document within the first book and identifying a second file including a list of docunit URLs, each of which is associated with a respective docunit included within the respective document; and

each of the docunit URLs identifying a respective third file including a list of the doctag URLs associated with respective doctag files included within the respective docunit.

30. The system of claim 29, wherein:

the tag repository comprises a list of domain URLs, each identifying a respective fourth file including the set of document URLs associated with documents composing a corresponding book; and

the network node comprises:

one copy of the tag repository; and

the second, third, and fourth files associated with the book hosted on that node.

31. The system of claim 26, wherein the iunits associated with a particular book are stored across at least one networked node.

32. The system of claim 23, wherein the tag repository comprises a single, global tag repository stored on a single computer.

33. The system, of claim 23, wherein:

the tag repository is distributed across a plurality of networked nodes;

the tagexporter is configured to export tags for a particular book to a respective tag repository located on a predetermined node; and

the tagfinder is configured to select relevant tags from among all of the tag repositories.

34. The system of claim 23, wherein:

the tag repository is distributed across a plurality of networked nodes running a filesystem;

the tagexporter is configured to create a common, shared directory including the tags for all of the books; and

the tagfinder is configured to select relevant tags from the common directly using utilities provided by the filesystem.

35. The system of claim 23, further comprising:

a tagmaker configured to update a respective tag database for the book every time the book is updated by writing new entries to the tag database for each new tagged iunit and updating existing entries in the tag database as required;

wherein the tagexporter is configured to export information about new and updated entries in the tag database to the tag repository.

36. The system of claim 35, wherein the tagfinder is configured to:

access, upon request of an author of the second book, all tag repositories associated with the document set; and

select tags from the accessed tag repositories corresponding to the iunits to be imported from the first book.

37. The system of claim 36, wherein the tagfinder is further comprising an importer configured to import the iunit into the second book.

38. The system of claim 37, further comprising an importer configured to import the iunit in a manner selected from by reference or by inclusion.

39. A network system for linking data in a document set including a plurality of books, comprising:

a plurality of networked nodes on which the books are stored; and

a network tag repository accessible to the networked nodes;

each of the networked nodes including:

a set of tags, each providing information about a respective information unit (iunit) from a first book stored on that node;

a tagexporter configured to export at least a subset of the tags to the network tag repository; and

a tagfinder configured to select from the network tag repository a second set of tags, each providing information about a respective iunit from a second book, and, based on the second set of tags, to import the respective iunits from the second book into any of the books stored on that node.

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